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RESEARCH ARTICLE

IMPORTANCE OF PHYSIOLOGY EDUCATION IN PHYSIOTHERAPY AND REHABILITATION

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ABSTRACT

Purpose: Physiology is an experimental science and is present in the fundamental education of medicine and health sciences. The study aimed to investigate the importance of physiology education in physiotherapy and rehabilitation (PT).
Material and Methods: The study retrieved the opinions of 249 participants (131 physiotherapists (PTs) and 118 PT students) on physiology education with an online questionnaire. The questionnaire included 30 items on the following subjects: physiology education, effects of physiology education on professional life, opinions on supplementary materials (laboratory brochures, books), and PT curriculum (lessons and lesson hours of physiology).
Results: Theoretical physiology education mainly employed PowerPoint or projection (66.4% of PTs and 55.1% of students), while practical education utilized supplementary materials in the laboratories of 40.5 % of PTs and 35.6 % of students. Nearly half of the participants (47.8%) declared the quality of the physiology education as moderate. A ratio of 41.2% of PTs and 44.9% of students neither agreed nor disagreed with receiving problem-focused physiology education. Participants considered that the most critical physiology course was exercise physiology. Furthermore, they stated that physiology education was essential in clinical practice and helpful in understanding other curriculum lessons.
Conclusion: Physiology education was critical in clinical lessons and professional life quality in PT. The results of the study recommend increasing and updating problem-based physiology education.

Keywords: Curriculum, education, human physiology, physiotherapy, students

INTRODUCTION

Human physiology is one of the fundamental sciences in the physical therapy curriculum, and it guides students and clinicians in learning clinical problem-solving skills (1). Moreover, physiology is an experimental scientific discipline. It is essential to the solid health education foundation. Many learning techniques for undergraduate students aim to teach the core principles of physiology: evaluation, ecosystems and environments, causal mechanisms, the cell, structure-function relationships, and levels of organization (2). The widespread teaching methods are online test skills, e-test animations and games, virtual labs, hand-held learning, and case-discussion studies (3). In 2001, the Nelson R. Mandela School of Medicine (NRMSM; Durban, South Africa) launched a problem-based curriculum in which physiology learning is integrated with relevant clinical scenarios. This curriculum expected students to understand physiology through self-research, in which certain aspects are addressed (4). Another study conducted with medical students concluded that physiology education was more crucial in the early years to master pathologies. However, this thought lost popularity because physiology is necessary to understand and interpret symptoms and laboratory results in more advanced classes (5).

Table 1. Demographic characteristics of the participants

Variables	Physiotherapists (n:131) Median (IQR)/ n(%)	students (n:118) Median (IQR)/ n(%)
Age, year median (IQR)	25(24-27)	22(21-22)
Gender Female, Male n(%)	86(65.6),45(34.4)	96(81.4),22(18.6)
Professional experience n(%)		-
0-1 years	26(19.8)	
<5 years	80(61.1)	
> 5years	25(19.1)	
Working place n(%)		-
University	11(8.4)	
Research hospitals	5(3.8)	
Hospital	18(13.8)	
Special education and rehabilitation center	48(36.6)	
Healthy Life Center	6(4.6)	
Public institutions	7(5.3)	
Physiotherapy center	36(27.5)	

IQR: Inter Quantile Ranging; n: number, %: percentage

Additional techniques, such as theoretical and practical training, can facilitate the teaching and learning process in different disciplines of knowledge (6, 7). This process is critical in health science education, such as PT, for understanding the physiological basis, essential for patient evaluation, and patient-specific treatment programs (8). Although physiotherapists conduct planning and implementing a personalized exercise program by considering the physiological effects of the treatment modalities they will apply, there is little information about physiology education in PT (9). Therefore, the current study aimed to investigate the significance of physiology education in PT according to PTs' and students' opinions.

MATERIAL AND METHODS

The study took place with volunteer PTs and PT students. The current research was conducted between January and March 2021 using a questionnaire delivered via Google Forms (Google, Mountain View, CA, USA).

Participants

The study enrolled 118 students and 131 PTs. All participants gave Informed consent to participate in the study. Individuals who received physiotherapy and rehabilitation undergraduate education and had a physiology course in their curriculum were in the study. On the other hand, individuals who did not complete the physiology course process and did not receive a passing grade from the university where they received physiotherapy and rehabilitation education, and have backgrounds in other health sciences or medical education were not in the study.

Questionnaire

Researchers developed a questionnaire with four parts inquiring about demographic data and 30 items on physiology education (about the curriculum, education, and clinical practice).

- The first-part items were about physiology education: the hours of the lesson, the title of the teaching instructor, the department of the teaching instructor, and theoretical and practical teaching methods.
- The second part consisted mainly of open-ended questions on Likert-type items (between 1 and 5). In the grading, the following expressions were given: 1 = "not effective," 2 = "slightly effective," 3 = "moderately effective," 4 = "very effective and 5 = "extremely effective." This section discussed the effects of physiology education on professional life and various PT lessons (general PT, orthopedics, cardiopulmonary, pediatric neurology, and neurological).
- The third part investigated the opinions of the participants via five-point Likert-type items "strongly disagree," "disagree," "undecided," "agree," and "strongly agree". Opinions on supplementary materials (laboratory brochures and books), curriculum, and the number of lesson hours were in this part.
- The fourth part discussed the advantages of physical therapy courses: Heat, Light, and

Hydrotherapy; Electro Physical Agents; Exercise Physiology; Basic Measurement and Evaluation in Physiotherapy; Manipulative Treatment Techniques; Principles of Treatment Movements; Neurophysiologic Approaches; Biomechanics and Kinesiology; Pediatric Rehabilitation; Orthotics, Prosthesis, and Rehabilitation; Orthopedic& Sports Rehabilitation; Pulmonary Rehabilitation; Cardiac Rehabilitation.

Table two contains all questionnaire items.

Validity of the Questionnaire

The Lawshe technique evaluated the content validity of the draft questionnaire (10). Within the scope of the Lawshe technique, a questionnaire was sent via email to three physiotherapists and two undergraduate PT students who were blind volunteers and clinically working on the prepared questionnaire. Coverage validity rates were based on the values by Ayre & Scally (11). For the answers of the five evaluators, the content validity ratio was at least 0.99 at the p=0.05 significance level. Cronbach's alpha determined the internal consistency of the validated questionnaire, and its value was 0.860.

Statistical Analysis

The Windows-based SPSS 20.0 statistical analysis program was used (Armonk, NY: IBM Corp). Data normality was tested with the Kolmogorov–Smirnov test. The survey results were expressed in percentages. The baseline characteristics of the participants were reported as median (IQR)/mean (SD). Chi-square and Fisher's exact tests analyzed categorical variables. The Mann–Whitney rank-sum test compared the ordinal data between the physiotherapist and students. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1 presents the baseline characteristics of the participants. Their mean age was 24.14 ±3.99 years. The clinical experience of the physiotherapists was generally less than five years (61.1%) (Figure 1). PTs mainly worked in special education, rehabilitation centers (36.6%), and PT centers (27.5%) (Figure 2).

Participants stated that weekly hours of the physiology course (Part I, Table 2) were mostly (PTs, 35.9% & students, 38.1%) four (two theoretical and two practical) for one semester. Most teaching members of the physiology course were from the faculty of medicine (PTs, 61.1%; students, 67.8%) and were professors (PTs, 50.4%; students, 33.1%). The practical education method was commonly computer/atlas (40.5%) in PTs versus laboratory (35.6%) in students. The theoretical teaching methods were mostly PowerPoint/projection (PTs, 66.4%, and students, 55.1%; Part I, Table 2).

Table 2 shows the participants' opinions on the effect of physiology education on PT in parts II, III, and IV. Opinions on the effectiveness of physiology education in clinical lessons in undergraduate education were mainly *very effective* (PTs, 32.8%, and students, 37.3%). The effectiveness of physiology education in the current clinical practice was mainly *moderately effective* according to the participants (PTs, 33.3%, and students, 37.5%). Therefore, the effectiveness of the physiology education in general PT (moderately effective), pediatric rehabilitation (moderately effective), neurological rehabilitation (very effective), orthopedic rehabilitation (moderately effective), and cardiopulmonary rehabilitation (very effective) lessons was graded differently (Part II, Table 2).

There were significant differences in some opinions between the physiotherapist and the students (Part III, Table 2). Unlike the students, PTs mostly

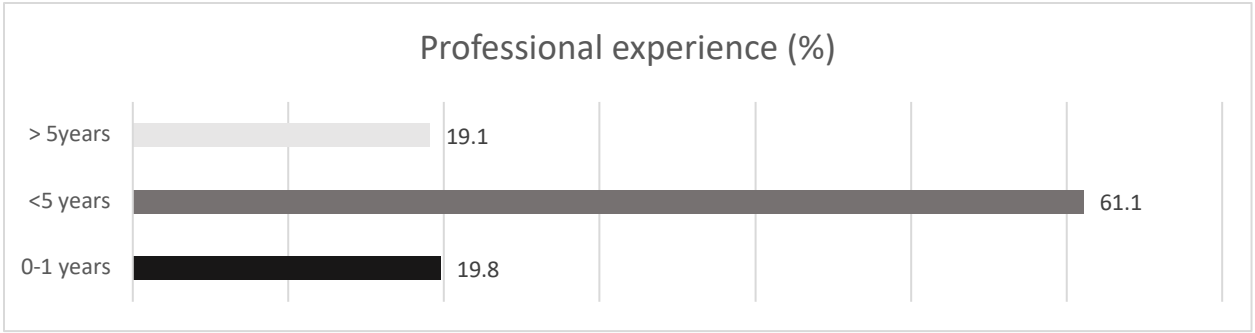

Figure 1. Professional's experience

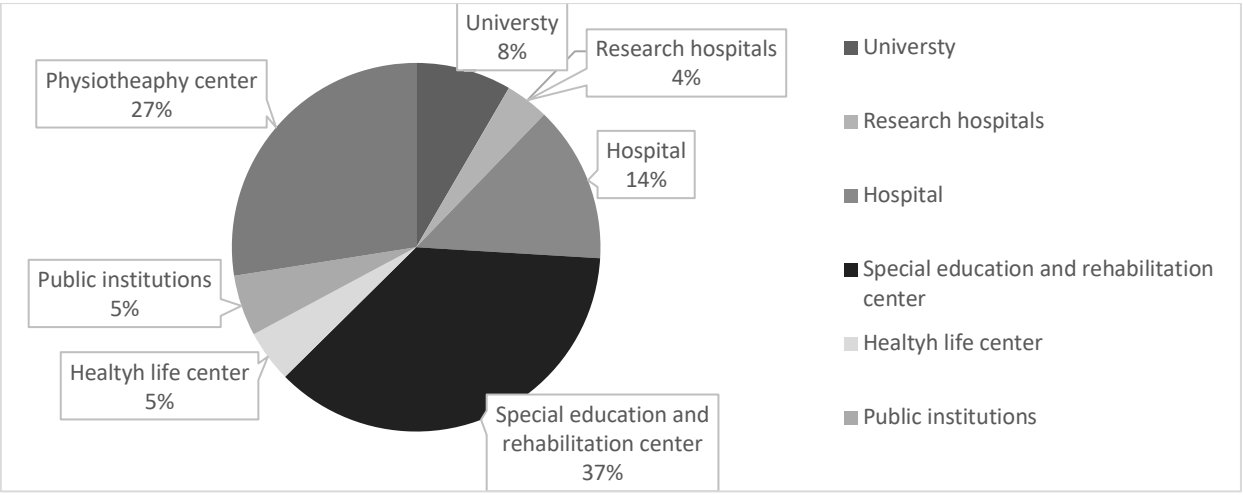

Figure 2. Professional's experience

disagreed with the opinion that the supplementary materials (laboratory leaflet and book) of practical training were sufficient (p = 0.025). Furthermore, they mostly agreed that an update in physiology education should take place in the PT's curriculum (p<0.001). PTs thought that physiology weekly course hours should increase (p = 0.002), contrary to the students' opinion. Approximately half of the participants (PTs, 49.6%, and students, 51.7%) agreed that continuity of physiology education was necessary for clinical practice after graduation. On the other hand, students mostly agreed that physiology education was essential for understanding a patient's signs and symptoms (p = 0.010). Students had difficulty in learning and reading any subject related to the physiology course (p = 0.015), contrary to the PTs.

PTs (49.5%) and students (51.7%) agreed that continuing physiology education is necessary for clinical practice after graduation. Participants (PTs, 61.1%; students, 59.3%) strongly agreed that physiotherapy and rehabilitation students should have physiology lessons made compulsory. Most participants (PTs, 43.5%, and students, 43.2%) wanted to take part in a physiology education other than undergraduate education. Most participants agreed with the following statements: regularly attending the physiology course is very beneficial for professional life (PTs, 53.4%, & students, 65.3%), practical training in human physiology lessons helps individuals gain skills (PTs, 45%, and students, 39%), and laboratory homework and quizzes after each practical training of the human physiology lessons contribute to learning (PTs, 42%, and students, 41.5%). Moreover, most participants agreed that *the practical training information was beneficial* and that *they use the physiology lesson notes and read them if they need for clinical practice.* PTs and students agreed with the following statements: they read evidence-based studies on the relevant search engines and checked the treatment program, they explained the physiological basis of the effects of the practice to the patients, and the physiology education helped to understand the other department lessons. Contrary to these opinions, they were indecisive about receiving problem-oriented education in physiology education (Part III, Table 2).

A standard answer to *How many lessons in the PT curriculum have you benefited from in physiology education?* was mostly one to four (PTs, 68.7%, and students, 61%). Nearly half of the participants (47.8%) stated that the quality of the physiology education was moderate. Participants answered the question "What is the necessary subject of physiology in PT education?" with exercise physiology (PTs, 45.8%, and students, 44.1%; Part IV, Table 2, Fig 3).

DISCUSSION

This study showed in detail the significance of physiology education in PT according to PTs' and students' perceptions. The important findings of the present study are as follows: 1) Physiology education was effective in PT, but the effectiveness graded on clinical lessons differed. 2) The supplementary materials (laboratory leaflet and book) used in the practical training and the tools and equipment were insufficient. 3) Physiology education was essential for understanding a patient's signs and symptoms.4) The requirement of continuing physiology education for clinical practice after postgraduate was generally

Table 2. Insights about curriculum and education

	Physiotherapist (n:131) %	**Students (n:118) %**
PART I		
Theoretical/practical Undergraduate Education Hours		
2T/2P	35.9	38.1
3T/2P	15.3	19.5
3T/3P	5.3	2.5
4T/3P	30.5	21.2
Other	13	18.6
Teaching Member		
Prof.	50.4	33.1
Associate Prof.	20.6	16.9
Asist. Professor	9.9	27.1
Lecturer	7.6	7.6
Others	11.5	15.3
Department of teaching instructor		
Physiotherapy	20.6	22
Veterinary medicine	0.8	1.7
Biology	11.5	6.8
Medicine	61.1	67.8
Other	6.1	1.7
Practical education method		
I. Experiment Animal	0	1.7
II. Laboratory	25.2	35.6
III. Simulation	1.5	0.8
IV. Computer / Atlas	40.5	26.3
IV. Other	24.4	22.9
II + IV	8.4	12.7
Theoretical education method		
I. Overhead projector	5.3	1.7
II. Writing board	3.1	4.2
III. Powerpoint /projection	66.4	55.1
IV.Other	3.8	0.8
I+II+III	2.3	4.2
II+III	19.1	33.9
PART II		
How would you evaluate the effect of your physiology education on clinical lessons in undergraduate education?		
Not effective at all	5.3	1.7
Slightly effective	21.4	16.9
Moderately effective	26.7	35.6
Very effective	32.8	37.3
Extremely effective	13.7	8.5
How would you evaluate the effect of the physiology education you on your practice in the professional life?		
Not effective at all	8.5	4.8
Slightly effective	19.4	15.4
Moderately effective	33.3	37.5
Very effective	24.8	35.6
Extremely effective	14	6.7
How would you evaluate the effect of your physiology education on General PT lessons?		
Not effective at all	3.8	1.7
Slightly effective	20.6	18.6
Moderately effective	32.1	37.3
Very effective	30.5	28
Extremely effective	13	14.4

Table 2. Continue

How would you evaluate the effect of your physiology education on Pediatric Rehabilitation lesson?		
Not effective at all	8.4	5.9
Slightly effective	23.7	23.7
Moderately effective	26.7	32.2
Very effective	25.2	22.9
Extremely effective	16	15.3
How would you evaluate the effect of your physiology education on Neurological Rehabilitation lesson?		
Not effective at all	4.6	3.4
Slightly effective	22.1	20.3
Moderately effective	26	26.3
Very effective	47	50
Extremely effective	0	0
How would you evaluate the effect of your physiology education on Orthopedic Rehabilitation lesson?		
Not effective at all	4.6	6.8
Slightly effective	19.1	25.4
Moderately effective	36.6	31.4
Very effective	28.2	19.5
Extremely effective	11.5	16.9
How would you evaluate the effect of your physiology education on Cardiopulmonary Rehabilitation lesson?		
Not effective at all	3.1	5.1
Slightly effective	16	15.3
Moderately effective	28.2	25.4
Very effective	28.2	30.5
Extremely effective	24.4	23.7
PART III		
Supplementary materials (laboratory leaflet and book) used in the practical training of the human physiology lesson are sufficient.		
Strongly disagree	20.6	22
Disagree	43.5	32.2
Neither agree nor disagree	24.4	20.3
Agree	11.5	25.4
I felt the insufficient of physiology education during the patient evaluation or treatment		
Strongly disagree	6.9	3.4
Disagree	23.7	16.1
Neither agree nor disagree	32.8	38.1
Agree	28.2	33.9
Strongly agree	8.4	8.5
An update on physiology education should be perform in the curriculum of the physiotherapy and rehabilitation department and more lesson hours should be added.		
Strongly disagree	4.6	0
Disagree	6.9	14.4
Neither agree nor disagree	15.3	28
Agree	45.8	39.8
Strongly agree	27.5	17.8
Continuity of physiology education is required in terms of clinical practice after graduation.		
Disagree	9.2	6.8
Neither agree nor disagree	22.1	20.3
Agree	49.6	51.7
Strongly agree	19.1	21.2

Table 2. Continue

Physiotherapy and rehabilitation students should have the physiology lesson education compulsory.		
Disagree	2.3	0.8
Neither agree nor disagree	6.9	5.9
Agree	29.8	33.9
Strongly agree	61.1	59.3
The physiology lessons I had in physiotherapy and rehabilitation education was sufficient.		
Strongly disagree	9.2	2.5
Disagree	24.4	17.8
Neither agree nor disagree	36.6	39.8
Agree	24.4	34.7
Strongly agree	5.3	5.1
I would like to take part in a physiology study other than undergraduate physiology education		
Strongly disagree	4.6	2.5
Disagree	13	6.8
Neither agree nor disagree	21.4	22
Agree	43.5	43.2
Strongly agree	17.6	25.4
Physiology education is important for understanding a patient's signs and symptoms		
Disagree	6.9	0
Neither agree nor disagree	9.2	7.6
Agree	42.7	56.8
Strongly agree	41.2	35.6
I have difficulty to learning while reading any subject related to physiology.		
Strongly disagree	5.3	4.2
Disagree	39.7	27.1
Neither agree nor disagree	26.7	21.2
Agree	19.8	39.8
Strongly agree	8.4	7.6
Attending physiology class regularly is very beneficial for my professional life.		
Disagree	4.6	0.8
Neither agree nor disagree	13.7	8.5
Agree	53.4	65.3
Strongly agree	28.2	25.4
The practical training of the human physiology lesson helped me gain skills.		
Strongly disagree	3.1	4.2
Disagree	9.9	6.8
Neither agree nor disagree	26.7	35.6
Agree	45	39
Strongly agree	15.3	14.4
The laboratory homework and quizzes after each practical training of the human physiology lessons contributed to my learning.		
Strongly disagree	4.6	5.9
Disagree	12.2	8.5
Neither agree nor disagree	32.8	30.5
Agree	42	41.5
Strongly agree	8.4	13.6
The tools and equipment used in the practical training of the human physiology lessons are sufficient.		
Strongly disagree	20.6	15.3
Disagree	35.9	41.5
Neither agree nor disagree	33.6	25.4
Agree	6.9	15.3
Strongly agree	3.1	2.5

Table 2. Continue

I can use the information I learned in the practical training of the human physiology lessons in my daily life.		
Strongly disagree	3.8	2.5
Disagree	12.2	11.9
Neither agree nor disagree	27.5	34.7
Agree	46.6	43.2
Strongly agree	9.9	7.6
When I need some physiological information during clinical practice, I open my physiology lessons notes and read it.		
Strongly disagree	1.5	1.7
Disagree	12.2	7.6
Neither agree nor disagree	20.6	15.3
Agree	52.7	59.3
Strongly agree	13	16.1
When I need some physiological information during clinical practice, I read evidence-based studies in relevant search motors and set the treatment programs.		
Strongly disagree	0.0	0.8
Disagree	9.9	6.8
Neither agree nor disagree	19.1	18.6
Agree	52.7	59.3
Strongly agree	18.3	14.4
I explain the physiological basis of the effects of the practices I apply in practical life to my patients.		
Disagree	9.2	9.3
Neither agree nor disagree	21.4	28.8
Agree	52.7	51.7
Strongly agree	16.8	10.2
I received a problem-oriented education in physiology education.		
Strongly disagree	9.2	5.1
Disagree	24.4	21.2
Neither agree nor disagree	41.2	44.9
Agree	19.8	22
Strongly agree	5.3	6.8
The physiology education helped me to understand other department lessons		
Disagree	6.1	4.2
Neither agree nor disagree	16.8	16.9
Agree	53.4	59.3
Strongly agree	23.7	19.5
PART IV		
How many lessons in the physiotherapy curriculum have you benefited from physiology education		
1-4 courses	68.7	61
5-9 courses	23.7	28
10 < courses	7.6	11
How do you evaluate the quality of your physiology education		
Bad	15.3	10.2
Moderately	51.1	44.1
Good	27.5	35.6
Very good	6.1	10.2
Which is the absolutely necessary subject of physiology in PT education		
Muscle contraction mechanism	31.3	30.5
Respiratory physiology	0.8	3.4
Circulatory physiology	4.6	2.5
Nerve physiology	17.6	19.5
Exercise physiology	45.8	44.1

Difficulty reading any physiology-related subject was mostly declared by students. 7) The most critical physiology subject was exercise physiology, and physiology education was more necessary in clinical practice and helped to understand other courses in the curriculum.

Physiology education, part of the core curriculum for all health science students, is essential for clinical application and multidisciplinary connections (12). A study showed that students' perception of their inter-professional competence improved after conducting an inter-professional education (IPE) experience during the renal physiology block of a graduate-level course (13). In the current study, most students and professionals declared that physiology education has practical impacts on clinical lessons, current professional life, and general PT lessons. Clinical physiology lessons should be added to the health sciences curriculum because of the effectiveness of active learning.

Physiology education is taught through PowerPoint presentations in most medical and health science schools (12). Poor results in traditional methods have led to research on novel teaching methods to encourage active learning and students' creativity (14). Novel learning methods and mediums in physiology education include animations, games, online homework, virtual laboratories, tactile learning, case studies, external resources, online testing (face-to-face), licensure exams, and social media. These techniques have helped to prepare students for the technologically advanced health profession workforce and study groups (3). In the current study, 64.1% of the participants in PTs and 54.2% of students stated that supplementary materials (laboratory leaflets and books) were insufficient in the practical teaching of human physiology lessons. Novel active learning methods should be blended with traditional methods in PT physiology education in line with technological advances.

Using animals in the practical teaching of physiology is still controversial. Appropriate approaches are therefore a constant subject of research. Studies comparing students' perceptions of animals to virtual (video/computer) laboratory courses in physiological sciences related to the effectiveness of the problem-based learning (PBL) hybrid curriculum are present in the literature (15). A study applied the PBL method as a hybrid curriculum with some lectures and hands-on lessons to support students' learning (16). Another study showed that students gave feedback as *helpful* and *incentivizing* after the introduction of integrated laboratory classes into their PBL curriculum (17). According to Goyal et al., radical changes are necessary for the practical physiology education of medical undergraduates. In the present study, 47.4% of students stated that reading any physiology-related subject was difficult. Both students and PTs were indecisive on whether they had received problem-oriented education in physiology (41.2% of PTs and 44.9% of students) (18). A study with physiotherapy students revealed varying applications of PBL-related skills in clinical practice. Further research would be useful to explore the factors that enable students to successfully put into practice the qualifications developed using a PBL approach (19).

Physiological information about practical skills is a guide in the clinic. A study indicated that nursing students learn the physiology content best when it directly relates to workplace experiences (20).

In clinical practice, many questions remain about the content and effects of physical rehabilitation interventions in children and youth with acquired brain injury. Therefore, it is crucial to identify gaps in the evidence to synthesize current knowledge about the impacts of physical rehabilitation interventions on functional recovery and daily functioning in children and youth with acquired brain injury and to guide future research. Knowing the physiological processes will contribute to this process (21).

Similar to previous study findings, most physiotherapists worked in special education and rehabilitation centers, and most participants stated that their physiotherapy education had a considerable impact on their professional lives. These clinics were where children and youth with acquired brain injury were trained, and although the effectiveness of physiology in neurological rehabilitation is mostly accepted, its impact on pediatric rehabilitation cannot be underestimated. Updating the human physiology curriculum with case studies related to practical skills in PT is recommended.

Bornman and Brend emphasized the need for more studies by health practitioners focusing on changes in clinical practice (22). Similar to the previous study, in the present study, most clinicians were willing to participate in a physiology study other than undergraduate physiology education in clinical practice.

PTs and students had differing opinions on some subjects, including the sufficiency of the supplementary materials (laboratory leaflet and book)

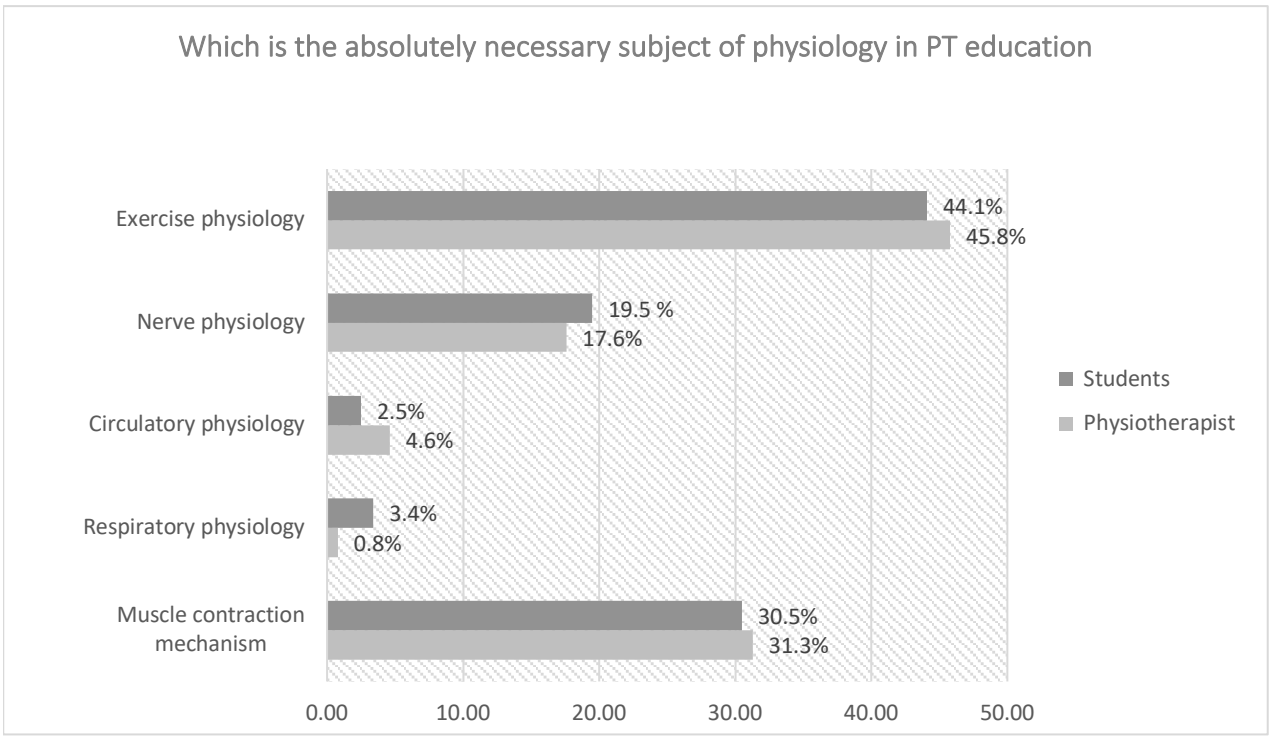

Figure 3. Which is the absolutely necessary subject of physiology in PT education

in practical training, whether an update on physiology education should be performed in the curriculum of the PT, the essentiality of physiology education for understanding a patient's signs and symptoms, and the difficulty in learning and reading any subject related to the physiology course. Although the students had difficulty reading and understanding physiology topics, they did not agree with the idea of adding additional courses. The differences in the developments in higher education according to the years may be due to the differences in thought, such as the difficulty of learning and reading any subject related to the physiology course (23). Additionally, the change in understanding with changes in years may also be related to the development of critical thinking skills, which is a way of thinking that consists of mental processes such as analysis and evaluation (24). In our previous study, the critical thinking levels of PT students who could get down to the core of their problems, evaluate the patient from every aspect in terms of rehabilitation, and offer different treatment methods were low in the training phase (25). It is recommended that training on problem-based learning and the physiological basis of these problems and treatment modalities should be higher in physiotherapy education.

This is the first study in Turkey on physiology education in physiotherapy and rehabilitation. It explored the significance of physiology education in practice and showed the differences in physiology education thought between students and clinicians. Nevertheless, there were some limitations in the study. The duration of clinical experience of the physiotherapists varied in the present study. A comparison of the perceptions of physiology education in PT according to the duration of clinical experience should be investigated. This could not be analyzed due to the heterogeneity of the clinical experience duration of PTs. Further studies with larger sample sizes are necessary to generalize the results. Most participants were from different universities, and the physiology curricula of these universities were not analyzed. Researchers should consider the differences in the physiology curricula at different universities.

CONCLUSION

This study showed the students' and PTs' opinions on the effectiveness of physiology education in PT. The supplementary materials (laboratory brochure and book) for the practical teaching of human physiology

lessons were insufficient. According to students, learning and reading about physiology were difficult. Attending a physiology course was very beneficial for PTs. Physiology education was essential to understand patients' signs and symptoms and explain to patients the physiological basis of the effects of PT applications. Although problem-oriented education was implied, physiology education, in general, helped to understand other PT courses. Exercise physiology was a necessary subject of physiology in PT education. Instead of PowerPoint/board, more simulation-based training or technology-supported physiology teaching can be practiced in PT education. Therefore, an update to the physiology education in the PT curriculum is necessary. Future research must investigate the significance of problem-based human physiology education for active learning in all health sciences.

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Author contribution: IH and NK came up with the project concept together. With the help of NK, IH gathered and analyzed the data. The authors made significant contributions to the manuscript's development. The final manuscript was examined and approved by IH and NK.

Conflict of interests: There is no declaration of interest.

Ethical approval: The study was approved by Hatay Mustafa Kemal University, Non-Interventional Clinical Research Ethics Committee, and performed in accordance with the Declaration of Helsinki (Date: 14.01.2020; Decision number: 22).

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